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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/529,581	08/12/2005	Dietrich Koch	268543US0PCT	9000
22850	7590	12/31/2007		
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER				
ZIMMER, ANTHONY J				
ART UNIT		PAPER NUMBER		
4116				
NOTIFICATION DATE		DELIVERY MODE		
12/31/2007		ELECTRONIC		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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### Office Action Summary

**Application No.**

10/529,581

**Applicant(s)**

KOCH ET AL.

**Examiner**

ANTHONY J. ZIMMER

**Art Unit**

4116

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 8/12/2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 August 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-850)
- Paper No(s)/Mail Date 3/29/2005
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Inventor's Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Status***

1. Claims 1-19 are pending and are subject to examination.

### ***Priority***

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Information Disclosure Statement***

3. The information disclosure statement (IDS) submitted on 3/29/2005 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
6. The term "slowly" in claim 4 is a relative term which renders the claim indefinite. The term "slowly" is not defined by the claim, the specification does not provide a

standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 1-6, 8-9, 12-14, and 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al. (hereinafter D1, see citation in IDS mail date 3/29/2005) in view of Heylen et al. (hereinafter D2, see PTO-892 for citation) and Fudala et al. (hereinafter D3, see PTO-892 for citation).

In regard to claim 1, D1 teaches a process for producing metal ion-exchanged pillared clays (catalytically active layered silicates). D1 teaches providing a pillared silicate (referred to as a pillared clay) and intercalating metal ions into the layers of the silicate using an wet ion exchange method, but does

not teach the process of preparing the pillared silicate (adding a metal solution to a layered silicate followed by drying) or a solid state ion exchange method of intercalating the metal ions into the layers of the silicate (adding a metal salt to the formed pillared silicate in a dry state and then heating to simultaneously dry and calcine the mixture while ion exchanging the metal ions into the intercalation layer) as required by claim 1. See section 2.1 of D1 on page 349.

However, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify D1 in view of D2 and D3 for the following reasons:

D2 teaches a process of forming an aluminum oxide pillared silicate (referred to in D2 as a pillared clay) by mixing a layered silicate into a Locron L solution (aluminum metal solution) and subsequently drying (and calcining) the mixture to generate the metal atom pillars. Though the process of D2 does not prepare the exact reactant ( $\text{Al}_2\text{O}_3$ -pillared delaminated laponite) used in D1, it would have been obvious to substitute a known similar pillared silicate (as the pillared silicate provided by D2 is also a  $\text{Al}_2\text{O}_3$ -pillared clay) as it would have been obvious to one of ordinary skill in the art to substitute one known  $\text{Al}_2\text{O}_3$ -pillared clay for another in order to affect the predictable result of producing a metal ion intercalated pillared clay. It would have been obvious to substitute the process of D2 for simply providing the reactant (as is the case in D1) in order to decrease production costs by producing a reactant from raw materials instead of buying it. See section 2.1.3 of D2.

D3 teaches a solid state process of intercalating metal ions into a layered silicate (montmorillonite). In particular, D3 teaches dry mixing a metal salt with a layered silicate and then heating (simultaneously drying and calcining) the mixture in order to incorporate the metal ions into the silicate layers. It would have been obvious to one of ordinary skill in the art to substitute the (wet) ion exchange process as used in D1 with the interchangeable solid state ion exchange process as disclosed in D3 in order to affect the predictable result of intercalating metal ions into the layers of the silicate. See the second paragraph on page 400 and the third paragraph on page 404 of D3.

In regard to claim 2, D2 teaches the use of an aluminum solution, Locron L solution. See section 2.1.3 on page 55 of D2.

In regard to claims 3 and 16, the dry mixture is heated to 773 K (500°C) in D3. See the second paragraph on page 400 of D3.

In regard to claim 4, in D2 the mixture of the layered silicate and the metal solution is filtered and washed and dried, thereby forming the metal atom pillars. See section 2.1.3 of D2 and the second sentence of the Introduction on page 53 of D2. Though D2 does not specifically say that the solution was filtered after washing, one of ordinary skill in the art would envisage filtering after washing all before the drying step in order to decrease drying time.

In regard to claims 5 and 6, D2 teaches, following the drying step, heating the dried solution at a heating rate of 10°C/minute (shock heating) (100°C/10 minutes). See section 2.1.3 on page 55 of D2.

In regard to claim 8, D3 teaches using metals salts of copper, nickel, cobalt, and iron. See D3, second sentence on page 400.

In regard to claim 9, D3 teaches using metal salts, but does not teach using copper nitrate in particular. See D3, second sentence on page 400. However, it would have been obvious to one of ordinary skill in the art to use copper nitrate as it is compound commonly used to intercalate copper into layered silicates, as it is used in D1 in the wet ion exchange reaction (see section 2.1 of D1).

In regard to claim 12, D2 teaches using montmorillonite (a three-layer mineral). See section 2.2 on page 55 of D2.

In regard to claim 13, D1 teaches forming a product with 360 m<sup>2</sup>/g of surface area from a laponite having a surface area of 384 m<sup>2</sup>/g. See Section 2.1 of D1 on page 349. Starting from the high surface area pillared silicate formed in D2 with a surface area of 382 m<sup>2</sup>/g (see second paragraph in the right column on

page 58 of D2), after ion exchange the material would exhibit a decrease in surface area similar in magnitude to that of the laponite used in D1 (about 25 m<sup>2</sup>/g) and would thus necessarily produce a product with a surface area greater than 300 m<sup>2</sup>/g.

In regard to claim 14, D1 teaches forming catalytically active Al-pillared clay. See D1 section 2.1 on page 349.

In regard to claim 15, D2 teaches using an aluminum oxide (polycationic) solution. See Section 2.1.3 of D2.

In regard to claim 17, the heating rate of D2 (10°C/minute) provides a heating rate high enough to heat the mixture from 100°C to 500°C in 30 minutes. D2 only teaches heating up to 400°C. However, it is well known in the art that temperature is a result effective variable in calcination processes. The particular range of temperatures presented is a matter of design choice and routine optimization well within the level of ordinary skill which fails to produce an unexpected result. Therefore, the particular temperature range as presented in claim 17 does not constitute a patentable distinction.



10. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over D1 in view of D2 and D3 as applied to claim 1 above and further in view of Long et al. (hereinafter D4, see PTO-892 for citation).

In regard to claim 7, D1 in view of D2 and D3 fails to teach processing the layered silicate by acid (to obtain a cationic condition) or base treatment (to obtain an anionic condition). However, it would have been obvious to one of ordinary skill in the art to modify D1 in view of D2 and D3 further in view of D4 as D4 teaches base treating a pillared clay (after pillar formation), followed by washing and drying. See Section 2 Experimental on page 39 of D4. One of ordinary skill in the art would have been motivated to modify D1 in view of D2 and D3 further in view of D4 in order to increase the cation exchange capacity of the pillared clay. See second to last sentence of the abstract of D4.

11. Claims 10-11 and 18-19 rejected under 35 U.S.C. 103(a) as being unpatentable over D1 in view of D2 and D3 as applied to claim 1 above and in further view of Ward (US4990476, hereafter D5).

In regard to claims 10, 11 18, and 19, D1 in view of D2 and D3, does not teach shaping (extruding) the product of claim 1, drying the shaped product, or adding an aluminum oxide binder. However, it would have been obvious to one of ordinary skill in the art to modify D1 in view of D2 and D3 further in view of D5 as D5 teaches extruding a mixture containing a pillared clay and a second inorganic refractory oxide binder (such as alumina (aluminum oxide)) and

calcining the mixture (and hence drying) the extrudate. See claims 20, 27, and 30 of D5. It would have been obvious to one of ordinary skill in the art to modify D1 in view of D2 and D3 further in view of D5 in order to produce a useable form of the ion exchanged pillared clays.

### ***Conclusion***

12. In sum, all claims are rejected, and no claim is allowed.

### ***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANTHONY J. ZIMMER whose telephone number is (571)270-3591. The examiner can normally be reached on Monday - Friday 7:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on 571-272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ajz

***/Vickie Kim/  
Supervisory Patent Examiner, Art Unit 4116***